

Debris Management Support Annex

Coordinating Agency

Public Works Department
Solid Waste Management

Cooperating Agencies

Parks and Recreation Department
Emergency Management
Virginia Department of Health – Roanoke Health Department
General Services Department
Roanoke Valley Resource Authority

I. Introduction

A. Purpose

To facilitate and coordinate the removal, collection, and disposal of debris following a disaster in order to mitigate against any potential threat to the health, safety, and welfare of the impacted citizens, expedite recovery efforts in the impacted area, and address any threat of significant damage to improved public or private property.

B. Scope

1. The debris management program implemented will be based on the waste management approach of reduction, reuse, reclamation, resource recovery, incineration, and land filling, respectively;
2. Public Works and agencies can reasonably be expected to accomplish expedient repair and restoration of essential services and vital facilities, but it may be necessary to contract for major reconstruction;
3. Public Works will be able to organize and carry out debris clearance in the aftermath of an emergency, but may require external assistance in debris removal if there are large quantities of debris or if debris includes hazardous materials;
4. Assistance may be available from other jurisdictions through local agreements (and from commercial firms through contingency contracts);
5. Damage to chemical plants, power lines, sewer and water distribution systems, and secondary hazards, such as fires, could result in health and safety hazards that may pose a threat to employees;
6. Local landfills and waste disposal facilities may be inadequate to deal with large amounts of debris and it may be necessary to use alternate methods and facilities for disposal;
7. The City may have insufficient resources to remove the debris created by a major emergency or disaster and accomplish other recovery tasks;
8. If local debris removal capabilities are insufficient, it may be necessary to execute a local emergency declaration and request the State assist in debris removal. If the local emergency situation is of such magnitude that the Governor requests a Presidential Disaster Declaration and such a declaration is approved, federal resources could become available.
9. For major emergencies or disasters, private contractors may be needed to collect, reduce the volume of, and dispose of debris;
10. Citizens will assist in removing debris from the immediate area of their homes and businesses, but will generally need government assistance in hauling it away for disposal; and

11. Citizens are often willing to help their neighbors in removing debris; proper public information can encourage such cooperative action, speeding up the process and reducing costs.

C. Policies

The debris removal process must be initiated promptly and conducted in an orderly, effective manner in order to protect public health and safety following an incident. Debris Management will be conducted in the following prioritized phases:

II. Concept of Operations

A. General

The Department of Public Works will be responsible for coordinating debris removal operations for the locality. The locality will be responsible for removing debris from property under its own authority, as well as from private property when it is deemed in the public interest/safety. Debris must not be allowed to impede recovery operations for any longer than the absolute minimum period. To this end, Public Works will stage equipment in strategic locations locally as well as regionally, if necessary, to protect the equipment from damage, preserve the decision maker's flexibility for employment of the equipment, and allow for the clearing crews to begin work immediately after the incident.

The Department of Public Works will work with Emergency Management in development and maintenance of a list of approved contractors who have the capability to provide debris removal, collection, and disposal in a cost effective, expeditious, and environmentally sound manner following a disaster. The listing will categorize contractors by their capabilities and service area to facilitate their identification by state agencies and local governments, as well as ensure their effective utilization and prompt deployment following the disaster.

The City will be responsible for managing the debris contract from project inception to completion unless the government entities involved are incapable of carrying out this responsibility due to the lack of adequate resources. In these circumstances, other state and federal agencies will be identified to assume the responsibility of managing the debris contract. Managing the debris contract includes such things as monitoring of performance, contract modifications, inspections, acceptance, payment, and closing out of activities. The City will seek out regional agreements to maximize the utilization of public assets. These should be pre-identified prior to the agreement being developed and implemented.

Debris storage and reduction sites will be identified and evaluated by interagency site selections teams comprised of a multi-disciplinary staff who are familiar with the area. A listing of appropriate local, state and federal contacts will be developed by the appropriate agencies to expedite the formation of the interagency, multi-disciplinary site selection teams.

Initially, debris will be placed in temporary holding areas until such time as a detailed plan of debris collection and disposal is prepared. This is not anticipated until after the local traffic has been restored. Temporary debris collection sites should be readily accessible by recovery equipment and should not require extensive preparation or coordination for use. Collection sites will be on public property when feasible to facilitate the implementation of the mission and mitigate against any potential liability requirements. Activation of sites will be under the control of the City engineer and will be coordinated with other recovery efforts through the local EOC.

Site selection criteria will be developed into a checklist format for use by these teams to facilitate identification and assessment of potential sites. Criteria will include such factors of ownership of property, size of parcel, surrounding land uses and environmental conditions, and transportation facilities that serve the site.

To facilitate the disposal process, debris will be segregated by type. It is recommended that the categories of debris established for recovery operations will be standardized. The categories of debris appear in Tab 1. Modifications to these categories can be made as needed. Hazardous and toxic materials, contaminated soils, household hazardous waste, and debris generated by the event will be handled in accordance with federal, state, and local regulations.

B. Organization:

The Public Works Department is responsible for the debris removal function and will work in conjunction with designated support departments, utility companies, waste management firms, and trucking companies, to facilitate the debris clearance, collection, reduction, and disposal needs of the locality following a disaster.

1. Emergency Roadway Clearance: Clear debris from major arterial roads in order to provide access for emergency vehicles and resources into the impacted area;
 - a. Following a disaster the top priority is to clear major roads and routes providing access to key population support facilities such as hospitals, to allow for the movement of emergency vehicles, resumption of critical services and damage assessment. Emergency roadway clearance also facilitates the deployment of external response elements and delivery of emergency equipment and supplies. In initial roadway debris clearance, debris is normally pushed to the side of the road and no attempt is made to remove or dispose of it.
 - b. In this phase, crews equipped with chain saws will generally be needed to cut up downed trees, and heavy equipment will be needed to move the remains. If possible, heavy equipment used for moving debris should be equipped with protective cabs and all personnel should wear protective equipment. Fire hydrants, driveway cutouts and utility valves should be left unobstructed; and
 - c. As electrical systems are often damaged by the same hazards that create substantial debris, debris management crews may need to coordinate their efforts to remove debris with utility crews.
2. Debris Removal and Disposal:
 - a. Debris removal from public property
 1. In the aftermath of a disaster, debris may have to be removed from a variety of public areas including:
 - a. Roads and rights of way;
 - b. Government buildings, grounds and parking lots; and
 - c. Storm drainage systems and reservoirs.
 2. If the emergency situation resulted in a Presidential Disaster Declaration, expenses of debris removal from public property may be partially reimbursed by the federal government if the debris must be removed to:
 - a. Eliminate immediate threats to life, public health and safety;
 - b. Eliminate immediate threats of significant damage to improved public or private property; and
 - c. Ensure economic recovery of the affected community.
 3. As large-scale debris removal and disposal operations can be extremely costly, it is vital to determine if federal assistance will be provided and the rules that apply to such assistance before commencing debris removal operations.
3. Debris Removal from Private Property
 - a. Debris removal from private property, including demolishing condemned structures, is generally the responsibility of the property owner and the cost may be wholly or partially covered by insurance. If there has been a Presidential Disaster Declaration and debris on private property is so widespread that public health, safety or the economic recovery is threatened, local government may be partially reimbursed for the cost of debris removal from private property. The City normally has the responsibility for picking up and disposing of debris from private property placed at the curb and bears the cost for the effort.

4. Preparation for Debris Removal

- a. Considerable time and labor can be saved in the debris removal process by sorting debris from public property and encouraging the public to sort from private property before it is picked up. A proactive public outreach program should advise the public of the actions they can take to facilitate pickup including:
 - 1. Sorting debris into categories (See Tab 1-Debris Classifications);
 - 2. Placing sorted debris piles curbside;
 - 3. Keeping debris out of the road and away from fire hydrants and utility services; and
 - 4. Disposing household garbage in normal refuse containers.

5. Estimating the Amount of Debris

- a. In determining the means to be used to remove and dispose of debris, it is essential that local officials have a reasonable estimate of the amount of debris that must be removed and eventually disposed of. Tab 3 (a-f) provides a methodology that may be used to estimate the amount of debris that must be removed.

6. Determining Debris Removal Strategy

- a. After an estimate of the amount of debris that needs to be removed is made, options for removing the debris should be evaluated in terms of their cost and timeliness.
- b. The general strategies for debris removal and processing are:
 - 1. Removal and processing of debris by local government
 - a. Advantages
 - 1. Direct government control
 - b. Disadvantages
 - 1. Normally requires diversion of significant government resources from regular functions and makes them unavailable for other recovery tasks;
 - 2. Speed of debris removal may be constrained by the government equipment and personnel available; and
 - 3. Local government may lack specialized equipment and skills needed to carry out all aspects of debris removal.
 - 2. Removal and processing of debris by contractors:
 - a. Advantages
 - 1. Speed of debris removal may be increased by contracting for additional resources
 - 2. If local contractors are used, may provide local economic benefit
 - b. Disadvantages
 - 1. Requires detailed contracts
 - 2. Requires extensive oversight and inspection
 - 3. Removal and processing of debris by a combination of local government and contractors.
- c. If contractors will be used, the disaster area should be divided into geographical sectors for control purposes and bids solicited based on the estimated quantity of debris in each sector. In defining

sectors, it is desirable to group properties of like type, construction and with similar vegetation together. This will also facilitate estimating the quantity of debris that needs to be removed.

- d. Debris may be removed by one time collection of all debris at each property or using multiple passes to collect different types of material that have been pre-sorted by the property owner.

7. Establishing Temporary Debris Storage and Reduction (TDSR) Facilities

- a. The effective disposal of large quantities of disaster debris requires that suitable temporary storage and volume reduction facilities are established. Such facilities hold debris until it can be sorted, reduced in volume and dispatched to an appropriate disposal facility. Sorting and volume reduction can significantly reduce the costs of disposing of debris and preventing potentially serious environmental problems.
- b. TDSR facilities sort debris and send it to the most appropriate facility for treatment or disposal. Sorting is needed to separate burnable from non-burnable materials and segregate hazardous products for disposal at authorized facilities and identify debris that can be burned, chipped or ground, recycled or simply disposed of at a landfill, without treatment.
- c. The volume of debris can be greatly reduced by a variety of methods, including:
 - 1. Incineration. This method includes open burning, use of air curtain pit incineration (trench burners), or use of portable air curtain incinerators. Incineration of burnable debris typically reduces its volume by 95 percent. Due to Roanoke Valley burning policies, a disaster declaration must be declared before any incineration operations are considered.
 - 2. Chipping and grinding. Chipping and grinding is appropriate for clean, woody debris and typically reduces the volume by 75 percent. However, chipping and grinding usually costs as much as incineration and unless the resulting mulch can be disposed of without cost or at a profit, local government may incur additional costs to have residual material hauled to a landfill.
 - 3. Recycling. Recycling debris may present an opportunity to reduce the overall cost of disposal. Metals, lumber and soil are the most likely candidates for recycling. Before local government attempts to operate a recycling operation, it is essential to determine if there is, in fact, a market for the materials sorted out in the recycling process; otherwise the output may simply have to be hauled to a landfill. Specialized contractors may be willing to undertake recycling, particularly for large amounts of debris that are well sorted.
- d. Site Selection
 - 1. Among the criteria that are pertinent in selecting TDSR facilities are:
 - a. Preferably government owned.
 - b. Large enough to accommodate a storage area, a sorting area, and volume reduction operation area(s).
 - c. Reasonable proximity to disaster areas and debris disposal sites.
 - d. Good road access.
 - e. Not in a residential area or in the vicinity of schools, churches, or other facilities with concentrations of the population.
 - f. Not in an environmentally sensitive area, such as wetlands or a water well field.
 - 2. Local landfills and possible local sites for TDSR facilities are described in attachment 5. The selection of specific sites to be used for TDSR facilities will normally be made by a team of local, state, and where appropriate, federal personnel, who are familiar with the local area and the specific environmental regulations governing such facilities.

8. Public Information and Instructions

- a. In the aftermath of an emergency situation, the Public Information staff should provide the public with detailed information on debris removal and disposal plans and procedures. Providing appropriate instructions to the public concerning debris removal can significantly reduce the time and costs involved. Public information on debris removal must start as soon as possible after the disaster – before people start moving and stacking large amounts of debris.
- b. Public instructions should encourage citizens to:
 1. Assist their neighbors, particularly the elderly or infirm, in removing debris;
 2. Move debris to curbside for pickup;
 3. Separate debris into categories determined by local officials; and
 4. Keep debris piles away from fire hydrants and utility valves.
- c. Public information should keep citizens advised of:
 1. Debris pickup schedules and the system of pick up, if various types of debris will be picked up on different days; and
 2. Self help disposal guidelines for citizens and businesses that wish to haul their own debris to a debris storage area or landfill.
- d. The normal methods of public information dissemination through the media should be used to provide information to the public. If loss of electric power has occurred, extra effort must be made to reach those without power using door hangers, flyers, signs and if necessary door-to-door outreach.

III. Responsibilities

A. Primary Department (ESF #3 Public Works)

1. Assign a representative as the Debris Management Unit Leader, who
 - a. Will supervise debris clearance from the public right-of-way;
 - b. Will coordinate debris management for public and private entities, and
 - c. Will oversee the repair and restoration of key facilities and systems following a disaster/emergency.
2. Develop sample contracts with generic scopes of work to expedite the implementation of debris management strategies;
3. Develop mutual aid agreements with other state agencies and local governments, as appropriate;
4. Identify and pre-designate potential debris storage sites for the type and quantity of debris anticipated following a catastrophic event;
5. Pre-identify local and regional critical routes in cooperation with contiguous and regional jurisdictions;
6. Develop site selection criteria checklists to assist in identification of potential debris storage sites;
7. Identify and coordinate with appropriate regulatory agencies regarding potential regulatory issues and emergency response needs;
8. Establish debris assessment process to define scope of problem;
9. Develop and coordinate prescript announcements with Public Information Office (PIO) regarding debris removal process, collection times, storage sites, use of private contractors, environmental and health issues, etc.;
10. Upon completion of debris removal mission, close out debris storage and reduction sites by developing and implementing the necessary site remediation and restoration actions;

11. Perform necessary audits of operation and coordinate with ESF #5 (Emergency Management) to submit claim for federal assistance
12. In conjunction with ESF #1 (Transportation), determine the transportation requirements necessary to conduct debris removal operations.
13. In conjunction with Roanoke Valley Resource Authority and the City Environmental Administrator, determine the capability of the landfill to accept disaster debris or establishing burn sites for disaster debris;
14. In conjunction with ESF #7 (Resource Support), contract with local vendors to conduct immediate debris removal operations and when the debris removal capacity exceeds local capabilities; coordinate with national companies to conduct debris removal;
15. In conjunction with ESF #1 (Transportation), determine the priority for clearing the road system in the county; and
16. Ensure that the Western Virginia Water Authority conducts the appropriate tests to confirm that water quality is maintained following the disaster.

B. Support Departments

1. ESF #1 (Transportation)

- a. Assist in obtaining transportation assistance as needed in the removal and disposal of disaster debris; and
- b. In conjunction with ESF #3 (Public Works), determine the priority for clearing the road system in the county.

2. City Attorney

- a. Identify and address potential legal, environmental, and health issues that may be generated during all stages of the debris removal process; and
- b. Develop the necessary right-of-entry and hold harmless agreements indemnifying all levels of government against any potential claims.

3. ESF #2 (Communications) and ESF #15 (External Affairs)

- a. Coordinate with ESF #3 (Public Works) or the Debris Management Unit Leader on developing detailed information on debris removal and disposal plans and procedures;
- b. Utilize multiple media sources such as Public Service Announcements (PSAs), flyers, and press releases, and
- c. Develop and coordinate prescript announcements with ESF #3 on debris removal process, collection times, storage sites, use of private contractors, and environmental and health issues.

4. ESF #4 (Firefighting)

- a. Conduct an immediate assessment on the capability and availability of firefighting resources in the county;
- b. Determine the need for firefighting services with ongoing fires as a result of the disaster; and
- c. Assist in the coordination of ESF #10 (Hazardous Materials) operations in the City during the debris Management process.

5. ESF #7 (Resource Support)

- a. With the support of ESF #3 (Public Works), contract with local vendors to conduct immediate debris removal operations and when the debris removal capacity exceeds local capabilities; coordinate with national companies to conduct debris removal;

- b. Coordinate with ESF #12 (Energy) to determine the number of residents without power so that adequate quantities of relief supplies can be ordered; and
 - c. Coordinate with all support agencies to ensure that adequate resources are available to conduct recovery operations;
6. ESF #13 (Public Safety & Security)
- a. Responsible for evacuation and traffic control
7. Homeowners/Private Property

Unless directed otherwise by City Council, or under extremely unusual circumstances, removal of debris from private property is the responsibility of the property owner. Residents will be asked to sort debris by: trees and brush, white goods (appliances), household hazardous waste, construction/demolition materials, regular garbage, and vegetation and place it at the curb for pick-up.

Tab 1 to Debris Support Annex

DEBRIS CLASSIFICATIONS*

Definitions of classifications of debris are as follows:

1. **Burnable materials:** Burnable materials will be of two types with separate burn locations.
 - a. **Burnable Natural Debris:** Burnable debris includes, but is not limited to, damaged and disturbed trees; bushes and shrubs; broken, partially broken and severed tree limbs and bushes. Burnable debris consists predominately of trees and vegetation. Burnable debris does not include garbage, construction and demolition material debris.
 - b. **Burnable Construction Debris:** Burnable construction and demolition debris consist of non-creosote structural timber, wood products, and other materials designated by the coordinating agency representative
2. **Non-burnable Debris:** Non-burnable construction and demolition debris include, but is not limited to, creosote timber; plastic; glass; rubber and metal products; sheet rock; roofing shingles; carpet; tires; and other materials as may be designated by the coordinating agency. Garbage will be considered non-burnable debris.
3. **Stumps:** Stumps will be considered tree remnants exceeding 24 inches in diameter; but no taller than 18 inches above grade, to include the stump ball. Any questionable stumps shall be referred to the designated coordinating agency representative for determination of its disposition.
4. **Ineligible Debris:** Ineligible debris to remain in place includes, but is not limited to, chemicals, petroleum products, paint products, asbestos, and power transformers.

Any material found to be classed as hazardous or toxic waste (HTW) shall be reported immediately to the designated coordinating agency representative. At the coordinating agency representative's direction, this material shall be segregated from the remaining debris in such a fashion as to allow the remaining debris to be loaded and transported. Standing broken utility poles; damaged and downed utility poles and appurtenances; transformers and other electrical material will be reported to coordinating agency. Emergency workers shall exercise due caution with existing overhead, underground utilities and above ground appurtenances, and advise the appropriate authorities of any situation that poses a health or safety risk to workers on site or to the general population.

- * Debris classifications developed and used by Corps of Engineers in Hurricane Andrew recovery.

Tab 2 to Debris Management Support Annex

DEBRIS COLLECTION SITES

**To be developed by Primary Department of the
Debris Management Annex**

Tab 3 to Debris Management Support Annex DEBRIS ESTIMATION

This attachment contains the following tabs:

1. Tab A – Estimating Debris Quantity.

This tab includes two worksheets (Worksheet 1 and Worksheet 2) which outline a methodology that can be used to estimate the quantity of debris produced by a disaster. The methodology allows the user to estimate the debris in various geographic areas (sectors) and then sum the amount of debris in each sector to determine the overall volume of debris that must be dealt with. The sectors developed in this process can be used in operational planning and contracting. To the extent possible, sectors should be drawn to encompass areas with buildings of similar construction and vegetative cover.

[The methodology in this tab should not be used for storm debris; use the methodology in Tab E instead.]

2. Tab B – Estimating Debris Removal Time.

This tab includes two worksheets (Worksheet 3 and Worksheet 4). The worksheets provide a methodology that can be used to estimate the time in days that it will take to remove specific quantities of debris given a known set of hauling resources and a reasonable estimate of the cycle time for those resources (time spent in pickup, hauling, unloading, and, waiting on one trip).

3. Tab C – Estimating Debris Disposal Quantity.

This tab include one worksheet (Worksheet 5) that outlines a method to determine the volume of debris that will have to be disposed of after sorting and volume reduction, given information on the composition of debris that must be disposed of. To utilize this methodology, you must remove a sample of debris in each sector and sort it to determine the characteristics of the debris from that sector. If the sample of debris is not representative of that within the sector, this method will be inaccurate.

4. Tab D – Estimating Requirements for Debris Processing.

This tab provides a worksheet (Worksheet 6) that can be used to estimate how much space will be required for temporary debris storage and reduction facilities. This worksheet is based on a US Army Corps of Engineers methodology.

5. Tab E – Estimating Storm Debris Quantity.

This tab provides a worksheet (Worksheet 7) that can be used to estimate the quantity of debris produced by a storm. This worksheet is based on a US Army Corps of Engineers methodology.

TAB 3A- ESTIMATING DEBRIS QUANTITY

Complete a separate Worksheet 1 for each Sector.
Transfer results from each Worksheet 1 to Worksheet 2.

CF = cubic feet & CY = cubic yards

Use Tab E for Estimating Storm Debris

WORKSHEET 1				
Sector:				
Description:		N = Number	M= Multiplier	CY =(N x M)
A. Homes (1800-2000 square feet)		100	300	30000
B. Mobile Homes		130	80	10400

C. Other Buildings	L = Length/ft	W = Width/ft	H = Height/ft	CF = (LxWxH)	CY = (CF/27) x.33
Apex Center	250	60	10	150000	1833
Anchor Fire Station	100	100	12	120000	1467
Teasdale School	125	100	10	125000	1527
Subtotal [sum the right column]					4827

D. Debris Piles	L = Length/ft	W = Width/ft	H = Height/ft	CF = (LxWxH)	CY (CF/27)
Crystal Creek @ Compton	150	8	4	4800	177
Hungry Hollow Bridge	80	20	8	12800	474
Willow Road @ Newton	100	16	5	8000	296
Subtotal [sum the right column]					947

WORKSHEET 2	Sector A	Sector B	Sector C	Sector D
<i>Debris Volume Estimate (cubic yards/CY)</i>				
A. Homes [from Worksheet 1]	30000	4200		
B. Mobile Homes [from Worksheet 1]	10400	2400		
C. Other Buildings [from Worksheet 1]	4827	1021		
SD = Structural debris (A + B + C)	45227	7621		
V = Vegetation Multiplier [see note]	1.3	1.1		
ST = Subtotal (SD x V)	58795	8383		
D. Debris Piles [from Worksheet 1]	947	1200		
E. SV = Sector Volume (ST + D)	59742	9583		
TOTAL [add entries in row E above]	69325			

Note:

V= Vegetative Multiplier:	<u>Vegetative Cover</u>	<u>V =</u>
	None	1
	Light	1.1
	Medium	1.3
	Heavy	1.5

TAB 3B - ESTIMATING DEBRIS REMOVAL TIME

Worksheets 3 and 4 may be used to estimate the time it will take to remove a quantity of debris given information on the quantity and capacity of the hauling resources available and estimates of the cycle time for those resources. Cycle time is the time it takes a cargo truck to complete a round trip. Cycle time is computed by adding the time it takes to load a truck, the round-trip travel time between the loading point and the off-load point, unloading time, and any unproductive waiting time. This methodology will be most accurate if you use times observed during actual operations, not theoretical numbers.

WORKSHEET 3	Sector A	Sector B	Sector C	Sector D
A. Debris to be Removed in cubic yards (CY) from Worksheet 2 or 7	59742	9583		
Removal Cycle (all times in hours)				
B. Estimated loading time	.2	.2		
C. Estimated travel time (roundtrip)	.4	.6		
D. Estimated unload time	.1	.1		
E. Estimated waiting time	.1	.1		
F. Cycle time (B+C+D+E)	.8	1.0		
G. Daily work period	7.5	7.5		
H. Cycles per day (G / F)	9	7		
Removal Time				
I. Capacity (CY) per cycle [Worksheet 4]	136	136		
J. Capacity (CY) per day [H x I]	1224	952		
K. Days to Clear Sector [A / J]	48.8	10.0		
L. Days to Clear All Sectors [add entries in Row K above]	58.8			

WORKSHEET 4	A. Truck Capacity (CY)	B. Units Available	C. Group Capacity (AxB)
Equipment			
Dump Truck, Light	6	4	24
Dump Truck, Medium	8	4	32
Dump Truck, Heavy	10	8	80
Capacity Per Cycle (CY) [sum the right column]			136

Note:

In estimating units available, it is essential to consider that some equipment may not be operationally ready each day. Hence, an out-of-service factor based on local experience should be applied to obtain a realistic estimate of equipment available for use on a daily basis.

TAB 3C - ESTIMATING DEBRIS DISPOSAL QUANTITY

Worksheet 5 provides a method of estimating the volume of debris that will have to be disposed of after volume reduction. It requires taking a sample of the debris in each sector to determine the percent of burnable debris (B below), the percent of burnable C&D debris (C below), the percent of non-burnable debris (D below) broken down by recyclable materials (D-1) and other material (D-2), and the percent of hazardous debris. In taking a sample, it is desirable to include debris from at least 10 properties.

Worksheet 5	Sector 1	Sector 2	Sector 3	Sector 4
<i>Sample Debris Characteristics</i>				
A. Debris volume [from Worksheet 2]	59742	9583		
B. % Burnable Natural Debris	.30	.40		
C. % Burnable C&D Debris	.32	.28		
D. % Non-Burnable Debris	.35	.32		
D-1. Potentially Recyclable	.07	.10		
D-2. Landfill	.28	.20		
E. % Hazardous Debris	.03	.02		
<i>Disposal Volume (cubic yards)</i>				
F. Burnable Natural Debris (A x B)	17922	3833		
F-1. Amount to be chipped/ground ¹	200	0		
F-2. Amount to be burned	17722	3833		
G. Burnable C&D Debris (A x C)	19117	2683		
H. Total Burnable (F-2 + G)	36839	6516		
I. Volume for disposal after burning (H x .05)	1841	326		
J. Volume for disposal after chipping or shredding (F-1 x .25)	50	0		
K. Non-Burnable Debris (A x D)	20910	3067		
L. Less Non-Burnable to be Recycled ²	5400	767		
M. Volume of Non-Burnable for Disposal (K - L)	15510	2300		
N. Volume (Non-hazardous) for Landfill Disposal (I + J + M) ³	17401	5693		
N. Total for Landfill Disposal [add quantities in row N above]	23094			
O. Volume for Hazmat Disposal (A x E)	1792	191		
P. Total for Hazmat Disposal [add quantities in row O above]	1983			

Notes:

1. Local officials need to decide how much debris to chip or grind instead of burning. The quantity should be based on a) the amount of chipped/ground wood that local government wants to retain for use as mulch and b) the amount that can be disposed of without cost or at some profit to landscape products firms. Since chipping and grinding costs approximately the same as burning and produces a higher volume of residue, there is little reason to chip and grind instead of burning if you also have to pay to have the resulting mulch hauled away.
2. This number should be based on the proportion of recyclable materials for which you can determine there is a ready market. Recycling materials for which there is no market leaves you sorted debris to haul to the landfill.
3. If mulch produced in the chipping and grinding operation is hauled away without cost, do not include it (Item J) in the equation because disposal of that material is no longer your problem.

TAB 3D - ESTIMATING REQUIREMENTS FOR DEBRIS STORAGE & PROCESSING SITES

This methodology may be used to determine the space required for debris storage and processing sites.

It assumes that:

1. Debris will be stacked 10 feet high.
2. 40 percent of a site will be used for storage; 60 percent will be used for sorting areas, separation between debris piles, roads, site buffers, and burn pits

WORKSHEET 6		
A. Debris Volume in cubic yards (CY) [From Worksheet 2 or 7]		69325
B. CY per acre assuming 10' stack height ¹		16117
C. Acres for debris storage only (A/B)		4.3
D. Multiplier for processing, roads, & buffers		1.66
E. Required facility area in acres ²		7.1

Notes:

1. If you plan to use a stack height other than the typical 10 feet, use the following formula to compute CY per acre:

$$CY = (\text{stack height in feet} / 3) \times 4840$$

2. Where the area requirement is large, the requirement is generally satisfied by establishing several sites that, taken collectively, provided the needed area.

TAB 3E- ESTIMATING STORM DEBRIS QUANTITY

Worksheet 7 may be used to estimate the quantity of debris that must be removed. This worksheet uses the formula $Q = H \times C \times V \times B \times S$, where:

- Q = the quantity of debris in cubic yards (CF)
- H = the number of households
- C = the storm factor in CY:
- V = the vegetation characteristic multiplier:
- B = the business/commercial use multiplier
- S = the storm precipitation characteristic multiplier

WORKSHEET 7	Sector A	Sector B	Sector C	Sector D
<i>Debris Volume Estimate – Storm</i>				
1. H = households	5167	2100		
2. C = Storm category	26	8		
3. V = Vegetation multiplier	1.5	1.1		
4. B = Business/commercial multiplier	1.3	1.0		
5. S = Storm precipitation multiplier	1.3	1.3		
6. $Q = H \times C \times V \times B \times S$	3405 57	2402 4		
TOTAL (add columns in item 6 above)	3645 81			

Notes:

- H = Households. If you do not know the number of households, estimate the number by dividing the population of the area by 3.

2. C = Storm Category	<u>Category</u>	<u>C =</u>
	1	2
	2	8
	3	26
	4	50
	5	80

3. V= Vegetative Multiplier	<u>Vegetative Cover</u>	<u>V =</u>
	None	1
	Light	1.1
	Medium	1.3
	Heavy	1.5

4. B = Business/Commercial Density Multiplier	<u>Density</u>	<u>B =</u>
	Light	1.0
	Medium	1.2
	Heavy	1.3

5. S = Storm Precipitation Multiplier	<u>Precipitation</u>	<u>S =</u>
	None to Light	1.0
	Medium to Heavy	1.3

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